



Belt thoroughly spoils caterpillars' appetite

With its active substance flubendiamide, Belt is the first representative of a new class of insecticides called diamides. This product excels through its rapid and long-lasting activity. Of equal importance is the fact that Belt can make a useful contribution to resistance management; moreover, it exhibits a high degree of safety for people and the environment.

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Shane Hand

Caterpillars feel most comfortable wherever they have plenty to eat – particularly when feeding on agricultural and horticultural crops. Left undisturbed, they won't stop at eating individual leaves – they can eventually destroy a whole field to the ground. In doing so, they cause an immense amount of damage to crops around the world. To make things worse, growing numbers of lepidopteran pests are showing resistance to many conventional insecticides, for example the caterpillars of *Plutella xylostella* (Diamondback moth), which are found in vegetable crops.

“The market introduction of Belt®, which is also on the market under the trade names Fame® and Fenos® has come at just the right time”, says Shane Hand, who, as Global Product Manager for flubendiamide at

Bayer CropScience, has the task of managing this successful product. In 2006, while his predecessor Robert Masters was still responsible for the product, it received its very first registration, in the Philippines. This was followed by further registrations in countries such as India, Chile, the USA and Colombia. Hand anticipates registration to be gained in Brazil during 2009.

Innovative insecticide class marks a new standard

Before the first registration could be achieved, chemists, biologists, physiologists, and toxicologists at Bayer CropScience spent several years working on flubendiamide, the active substance behind Belt.

Flubendiamide is literally in a class of its own, because it is the first representative of a new group of active substances, which the researchers have named phthalic acid diamides. In contrast to the four known classes of insecticides, which target the insect's nervous system, the phthalic acid diamides act at receptors in muscles – the so-called ryanodine receptors.

Belt demonstrates its efficacy in as little as one to two hours after application. After taking up the compound, caterpillars lose the control of their muscles and stop eating; they become paralyzed through the constant muscle tension and finally die. The compound's additional strengths include rapid rainfastness and efficient uptake into the leaves, followed by acropetal translocation of the active substance to the new growing points of the leaves. Even small quantities are effective over a prolonged period, so that depending on the situation, the possibility exists of saving on the number of applications.

“A chemical component of the South American shrub *Ryania speciosa* has a similar mode of action”, according to Shane Hand, “but the crop protection agent based on it, ryanodine, had a serious disadvantage: it was equally toxic to people, birds and fish.” After careful customization in Bayer CropScience's laboratories, the opposite is true of flubendiamide: it acts selectively against caterpillars, and spares bees and other beneficial insects such as predacious bugs and parasitic wasps. “It's also safe for the user and

the environment – for mammals, birds, fish and earthworms – as long as it is used according to the rules of good agricultural practice”, continues the Product Manager. “Belt is therefore an important tool in the context of integrated crop protection.”

Belt is just the start

Resistance to many conventional insecticides is increasing around the world, so this new mode of action represents an important milestone in the story of Bayer CropScience's research into insecticides. Shane Hand adds: “Belt is the product of choice against tough caterpillar pests – there is no evidence of resistance. But to maintain this advantage, Belt should always be applied in alternation with insecticides from other classes of active substance, for example with pyrethroids and benzoylureas, resistance development can be prevented, and the reliability of control of pests in a wide variety of crops – such as cotton, corn, soybean, vegetables, fruit and rice – can be maintained.”

With this number of ground-breaking advantages, flubendiamide will certainly not remain the only active substance from the phthalic acid diamide class. Researchers are already working on related substances that interfere with the muscle receptors of other insect pests. If their work is successful, aphids and whiteflies might be controlled in the future in an equally selective and successful manner. ■

Belt – a new standard for lepidoptera control:

- New mode of action
- Very broad-spectrum lepidoptera control
- Outstanding larvicidal activity at low rates
- Fast-acting and long-lasting effect
- Rapid cessation of feeding
- Safe to pollinators and beneficial insects
- Broad crop utility
- No cross-resistance
- Suitable for Integrated Pest Management and Integrated Resistance Management
- High degree of safety (user, environment)

How Belt works

The active substance flubendiamide acts within the muscle fibers of an insect. It docks onto the ryanodine-receptors in the myofibrils. As a result, large amounts of calcium move out of the calcium depot (sarcoplasmic reticulum) into the myofibrils, where calcium's role is to allow the myosin filaments to glide past the actin filaments. The myofibrils contract and the muscle enters a state of permanent tension, leading eventually to the death of the insect.

